

around him, or of that physiology which does not lead to healthy living. The book appears to be intended for teachers rather than for students; but it is not very conveniently arranged. A certain amount of information is given on each topic handled, but usually not enough for a teacher who has not already considerable knowledge of the subject; and a number of questions is asked, often in a style that is almost irritating: e.g. "Which senses are very acute? Why? Dull? Why?"

But apart from matters of taste in style, it would be better to separate the volleys of questions from the descriptive text. The unfortunate teacher attempting to get up his lesson has now to wade through dozens of unanswered queries in order to pick out from them a few morsels of information scattered here and there over many pages of text. On the other hand, the trained and experienced teacher will derive few, if any, new ideas as to method, though he will probably welcome the excellent coloured diagrams.

The plants and animals examined are for the most part those which find place in the elementary courses in vogue in this country; but there are, of course, frequent allusions to American species. Of the three parts contained in the volume we prefer that devoted to human biology. In this part, information and questions are kept distinct, and the standard is just what is wanted for instructing pupils in the healthy working of the human body and for emphasising the importance of cleanly and active habits.

The pages are not entirely free from error. Etymologists will be startled to learn from Mr. Bailey (p. 60, part i.) that "parenchyma=parent+chyma, or tissue." We are tempted to inquire what derivation he would invent for "prosenchyma," and would venture to recommend a study of the Greek prepositions. Similarly, we question whether "batrachia" can be rightly translated "twice breather"; certainly the word is not synonymous with amphibia (p. 127, part ii.). The statements on p. 172, part ii., concerning migration are inaccurate; nor is it correct to state that the ferments (or enzymes) present in the digestive juices are "vegetable substances" (p. 100, part iii.). The figure (219) on p. 116, part ii., is that of a lamprey, not of an eel as stated in the legend.

O. H. L.

OUR BOOK SHELF.

Schlich's Manual of Forestry. Vol. V., Forest Utilisation. By W. R. Fisher. Pp. xii+840. (London: Bradbury, Agnew and Co., Ltd., 1908.) Price 12s. net.

WITH the appearance of this edition the whole subject of forest utilisation is brought thoroughly up to date. Prof. Fisher has given to English readers an admirable translation of what may be recognised as the best work on the subject. The German edition is itself based on Gayer's "Forstbenutzung," which was for many years the standard work, but with the lapse of time a new up-to-date edition became necessary to bring the book into touch with modern experience and practice. The task of writing a new edition was undertaken by Prof. H. Mayr, a former pupil of Gayer, and at present

his successor in the chair of forest utilisation in the University of Munich.

The volume is divided into four parts. Part i. deals with the principal forest produce, wood, in relation to its harvesting, conversion, and disposal. Part ii. treats of minor forest produce, its properties, utilisation, value, and disposal. In part iii. is considered the utilisation and disposal of the minor produce from the soil of the forest, while in part iv. the utilisation of the components of the forest soil, such as stone, gravel, &c., is given, and at the end we have a very useful index.

The whole work is profusely illustrated, and in this edition the number of illustrations has been increased by 73, making a grand total of 402, together with 5 full-page plates.

Of the several volumes which constitute Schlich's "Manual of Forestry," this one is probably the most complete in the treatment of its subject. The various parts are divided into chapters, and these, again, into sections, each section containing a clear and concise account of the subject or operation with which it deals. The student as well as the practical forester will find this volume a regular mine of information. This work will be found equally useful in Britain, our colonies, and elsewhere, as it deals with forest utilisation in its broadest sense. In fact, the authors have made use of all the available research of the nineteenth century in bringing the work up to date. The German work naturally gives most prominence to German matter, although at the same time taking into consideration that of other countries. The translator has added to this, and based the work on a still broader foundation, in order that it may be applicable wherever the English language is spoken.

This volume is sure to be appreciated by a large number of forest-owners and foresters all the world over, and it can be confidently recommended as the best and most exhaustive work dealing with the important and world-wide industry of forest utilisation.

Parallel Paths: a Study in Biology, Ethics, and Art. By T. W. Rolleston. Pp. xv+299. (London: Duckworth and Co., 1908.) Price 5s. net.

THE author contributes this thoughtful book towards "the establishment of a spiritual view of the universe on a natural basis." He believes that there is more in life than chemical and physical forces. The "living machine" that we hear so much about "differs essentially from other machines in not being a machine at all, or anything in the least like one." In support of his vitalistic position, the author refers in a lucid way to the difficulty of giving any chemico-physical interpretations of development and adaptability. "The master-word is nature's will to live." He considers the Lamarckian position and abandons it, noting, for instance, that if bodily characteristics acquired by exercise were transmissible by inheritance, the new-born child of right-handed ancestry ought to show some appreciable preponderance in weight and size of the right over the left limb. But he is not satisfied with Weismann's explanation either, though he admires the brave attempt to steer between the Scylla of Lamarckism and the Charybdis of "metaphysics." All evolution theories assume the responsive powers of protoplasm. But what does it respond to? If, as Weismann says, "the response is only to differences in the amount of nutriment obtainable by the various determinants of the germ-cell, and has only a fortuitous connection with the results attained," then how can we interpret adaptations such as that of the fish, Anableps, with its bifocal eyes? Thus the author is led to "a directive

theory of evolution," somewhat like that of the botanist Reinke. Man, the growing-point of progressive life, is conscious of directive control. Is there anything more real and certain to him, and is it not the x factor in all life and evolution? "The master-word is nature's will to live," and as man is not an outside observer of the universe, but an organic part of it, the author goes on to show, in very interesting chapters, that ethics is for life, and that art is man's expression of life. J. A. T.

A Course of Pure Mathematics. By G. H. Hardy. Pp. xvi+428. (Cambridge: University Press, 1908.) Price 12s. net.

THE title of this book is rather a misnomer. As a matter of fact, the most interesting part of it is in the last two chapters, which contain an excellent discussion of the logarithmic and exponential functions based upon the definition of $\log z$ as an integral. The preceding eight chapters deal with real and complex variables, limits, convergence of series, and the fundamental theorems of the differential and integral calculus. They are chiefly interesting as an illustration of the fact that there is a growing number of university teachers who are resolved that, if they have to teach elementary calculus, they will do it in the most rigorous way that they can, exposing the fallacies which used to be calmly ignored. There is a large number of examples, many of which show how much more attention has been given of late years in Cambridge to the elements of general function-theory. Mr. Hardy's book is more likely to be regarded as a work on the calculus than anything else; as such, it will be a useful companion to such treatises as those of Lamb and Gibson. M.

Clay Modelling in Manual Training from Plan, Elevation, and Section. By F. W. Farrington. With an Introduction by J. W. T. Vinall. Pp. 47; plates xl. (London: Blackie and Son, Ltd., 1908.) Price 3s. net.

Clay Modelling in Manual Training. Scholars' Handbook. (Same publishers.) Intermediate and Senior, plates xl., price 4d. net. Junior, plates xvi., price 3d. net.

ANY practical pursuit which leads to a scientific training of the hands and eyes of young pupils should receive encouragement in the schools; and modelling in clay can, in the hands of a skilful teacher, become a very useful aid in teaching several subjects. Mr. Farrington indicates how clay modelling may assist school teaching in arithmetic and geography, but hardly develops sufficiently these and similar practical applications of this form of manual work. The books will serve to provide young teachers and pupils with helpful guidance.

Handbook to the Technical and Art Schools and Colleges of the United Kingdom. Compiled from Official Information. With an Index to Courses of Instruction. Pp. xii+140. (London: Scott, Greenwood and Son, 1909.) Price 3s. 6d. net.

THIS useful directory of some of the most important schools and colleges in the British Isles providing instruction in science, technology, and art gives information as to the governing authority, principal, and secretary of each of the institutions dealt with, and particulars as to the courses of instruction arranged at each centre. Though comprehensive, the directory is not complete, and it may be hoped that the request made by the publishers for data of schools omitted will be complied with by the respective authorities, so that the omissions may be rectified in the second edition.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Ionisation in the Atmosphere.

THE apparatus designed by Ebert has been widely used to determine the total charges per c.c. of the positive and negative ions in the atmosphere. Except under unusual conditions, the measurement of the positive charge exceeds that of the negative charge by an amount very variable, which averages perhaps about 20 per cent. Thus the ratio of the charges has an average value not far different from the ratio of the mobilities of the ions or from the ratio of their coefficients of diffusion.

The apparatus consists of a metal cylindrical testing vessel with an insulated axial rod connected with the central system of an electroscope. Air is drawn through the testing vessel at a known speed by a small turbine driven by clockwork. The quantity of electricity received by the central charged rod is determined from a knowledge of the electrical capacity and observations of the loss of potential.

The following simple experiments by Mr. F. W. Bates and the writer led to unexpected results. A large hollow cone of cardboard was placed so that the air entering the testing vessel all passed through the cone, and the air during its passage was strongly ionised by the β and γ rays of radium, or by the γ rays alone. The instrument itself was well screened from the rays, and the radium bromide (14 mg.) was carefully sealed in a test-tube so that no emanation escaped. The position of the radium was varied, so that the number of ions detected in different experiments covered a wide range.

Assuming the value of the ionic charge to be 3.4×10^{-10} E.S.U., and supposing that every ion carried unit charge, then the values obtained, after necessary small corrections, gave the following average number of ions per c.c.:-

| Series | Positive ions | Negative ions | Ratio |
|----------------|---------------|---------------|-------|
| 1 ... | 37,570 | 34,300 | 1.09 |
| 2 ... | 19,900 | 10,100 | 1.99 |
| 3 ... | 22,320 | 16,820 | 1.33 |
| 4 ... | 14,350 | 11,850 | 1.21 |
| 5 ... | 7,280 | 5,800 | 1.25 |
| | | Mean | 1.39 |
| Without radium | 1,280 | 1,050 | 1.22 |

The variation in the ratio may be due to changes in the humidity or to the presence of dust.

The main point is, however, strongly marked. Whilst the γ rays of radium produce equal quantities of positive and negative electricity when they ionise gas in a closed vessel, we find that on ionising air near Ebert's apparatus there appears to be a large excess of positive electricity.

Care has been taken in designing the apparatus to avoid an external field. Since negative ions are under almost all conditions more mobile than positive ions, we should expect the negative ions to be captured more readily than the positive in the testing vessel, unless, indeed, some of the positive ions had a double charge. Again, it is possible that a large number of the negative ions diffuse to the top and sides of the testing vessel before entering it. In that case the diffusion is unexpectedly rapid. Moreover, the ratio, positive to negative, remained unchanged when the air was drawn through an earthed wide-meshed wire cylinder, when the loss by diffusion of the negative ions might be expected to show a relative large increase.

The details require further investigation, but the main and important result seems to be well established, namely, that the Ebert apparatus, and others of like type, are misleading in indicating a large excess of positive over negative electricity in the atmosphere. Thus when observers have recorded the average ratio as 1.2 there may really have existed equality, and the apparent excess may be due to the inequality of the rate of diffusion of the two